
PROPULSION DIRECTORATE

Monthly Accomplishment Report September 2004



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GLOBAL HAWK TEAM WINS AIR FORCE S&E AWARD: The Global Hawk Low Spool Generator Team recently won the Air Force Science and Engineering Award for Exploratory or Advanced Technology Development. This team was recognized for skillfully transitioning an innovative technology to the Global Hawk unmanned aerial vehicle (UAV). This technology, a low pressure spool generator, provides additional electric power at altitude while improving stall margin. This low spool generator is capable of providing a three-fold increase in available power at mission altitudes, which allows the Global Hawk to utilize the latest state-of-the-art sensor technologies. Without the addition of the low spool generator, the Global Hawk does not generate enough power to operate these advanced sensors. As part of this effort, the low spool generator was integrated with an AE3007 turbine engine (the Global Hawk's propulsion powerplant)



The Global Hawk Low Spool Generator Team recently won the Air Force Science and Engineering Award for Exploratory or Advanced Technology Development

and successfully tested. The Global Hawk Low Spool Generator Team consists of Dr. Russ Spyker, Messrs. Eugene Hoffman (retired), Edward Durkin, Peter Lamm, Steve Sepeck, Tom Lamp (retired), Lance Chrisinger, and Ken Semega. (Col M. Heil, AFRL/PR, (937) 255-2520)

PDE TEAM CONDUCTS ACOUSTIC TESTS AND ENGINE DEMO: Acoustic contour and vibration studies were recently completed as part of the Propulsion Directorate's Pulsed Detonation Engine (PDE) Flight Program. These efforts were conducted in collaboration with AFRL's Air Vehicles and Human Effectiveness Directorates, as well as Wright-Patterson AFB's (WPAFB) Bioenvironmental Engineering Flight. Testing was conducted at the historical Wright Field runway, adjacent to the Air Force Museum at WPAFB, Ohio. Engine run-ups were performed over the course of three days using the PDE installed on the world's first FAA flight certified PDE powered aircraft, N90EZ. Preliminary results from these tests indicate that acoustic levels are similar to a B-1B Bomber. In addition to acoustic testing, an engine demonstration was performed as part of the [2004 Turbine Engine Technology Symposium](#) banquet. During the demonstration, test pilot Mr. Mike Melvill* taxied the PDE powered aircraft in front of over 600 people before delivering the banquet address, where he described the groundbreaking flight in which he became the first civilian pilot to earn astronaut wings. The PDE-powered aircraft had recently returned from Mojave, California, where it underwent high speed taxi tests at the Mojave Civilian Flight Test Center. Despite the higher altitude and temperatures in Mojave, the engine was detonating but thrust was low. Consequently, the aircraft

* Mr. Melvill is the Vice President/General Manager and Test Pilot at [Scaled Composites LLC](#).

was returned to WPAFB in order to diagnose and fix the cause of the low thrust. AFRL's Propulsion and Air Vehicles Directorates have jointly funded this program with technical support from the Human Effectiveness and Materials and Manufacturing Directorates in order to demonstrate the viability of this revolutionary propulsion technology on a manned aircraft. (Mr. J. Stutrud, 1Lt P. Litke, and Dr. F. Schauer, AFRL/PRTC, (937) 255-6462)



Curt Rice (left) unplugs the start cart as Dr. John Hoke reviews final system checks with test pilot Mike Melvill, the world's first civilian astronaut



Test pilot Mike Melvill taxis down the WPAFB Museum Runway in front of over 600 people in N90EZ, the world's first FAA flight certified Pulsed Detonation Engine powered aircraft



The Pulsed Detonation Engine powered aircraft team (left to right): Lt Paul Litke and Jeff Stutrud (AFRL/PRTC); Dr. John Hoke (ISSI); Astronaut and test pilot Mike Melvill (Scaled Composites); Dr. Larry Byrd (AFRL/VAS); Dr. Fred Schauer, Capt Colin Tucker, Dr. Robert Hancock, and Lt Jason Gallia (AFRL/PRTC); Royce Bradley and Curt Rice (ISSI); and Craig Neuroth (AFRL/PRTC)

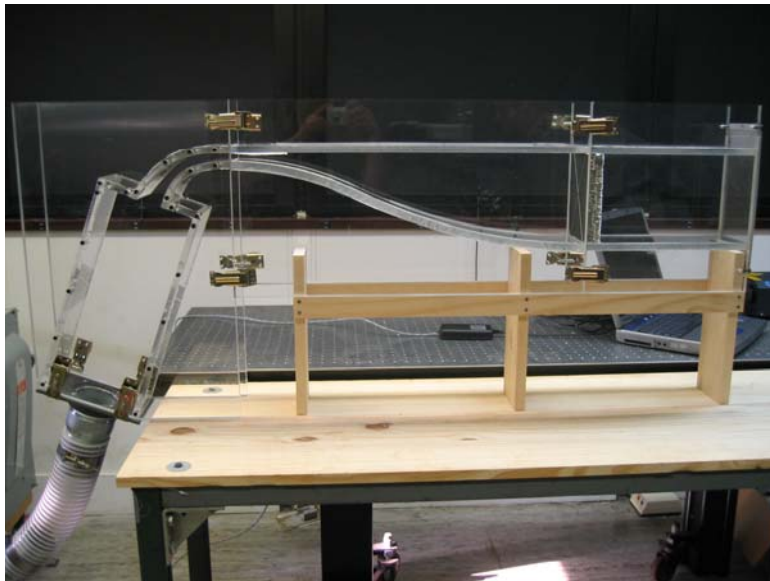
PR DEPUTY DIRECTOR RETIRES AFTER 43 YEARS OF SERVICE: The Propulsion Directorate's Mr. Fred W. Oliver retired on 1 October 2004 after more than 43 years of dedicated federal service. At the time of his retirement, Mr. Oliver was serving in the role of PR Deputy Director; however, he served in many diverse roles during his career. His federal service



Mr. Fred Oliver recently retired after more than 43 years of Government service

began in 1961 as a cooperative education student, and after graduating, he served as an in-house researcher, R&D contract monitor, and the manager of a major advanced development program. He was also responsible for two of the DoD's extravehicular space experiments aboard Gemini and Skylab. Mr. Oliver later advanced to leadership positions, serving as a branch chief and then division chief before becoming the PR Deputy Director. Over the years, he developed a reputation as an articulate and enthusiastic spokesperson for the Propulsion Directorate, and his influence is unmistakable throughout PR. On the occasion of his retirement, Mr. Oliver was presented with the prestigious Outstanding Civilian Career Service Award. (Col M. Heil, AFRL/PR, (937) 255-2520)

INITIAL OPERATION OF FLOW CONTROL WIND TUNNEL: On 6 October 2004, personnel in the Propulsion Directorate's [Compressor Aero Research Lab \(CARL\)](#) achieved initial operational status for a small wind tunnel to be used for flow control concept

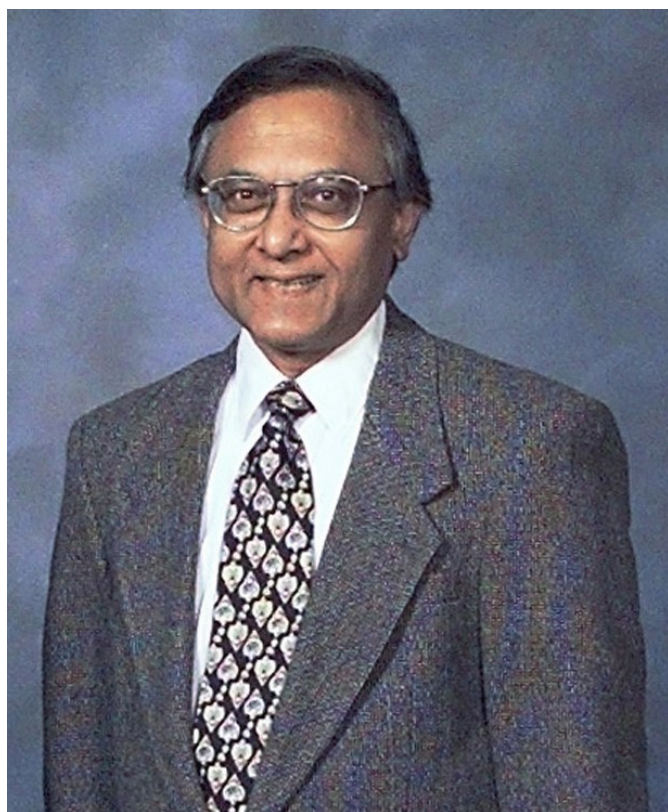


PR's new wind tunnel to be used for flow control concept evaluation

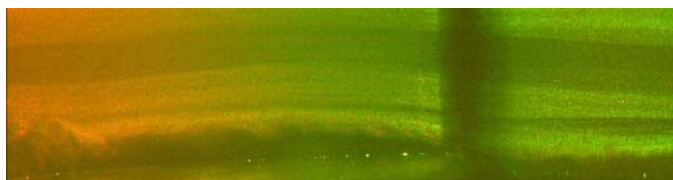
evaluation. This low cost, quick turnaround device simulates a single stator blade row passage with an inlet Mach number of 0.7. This new wind tunnel will allow detailed investigation of blade surface flow control approaches that enable high stage loading for compression systems. Increased stage loading and overall pressure ratio contribute directly to the PRT VAATE performance goals. Digital Particle Image Velocimetry (PIV) data were obtained for the baseline configuration. Near-term concepts for rapid diffusion to be investigated include blowing and

suction in an inset cavity on the suction surface in the co-flow and counter-flow directions. (Dr. S. Puterbaugh, AFRL/PRTF, (937) 255-7432)

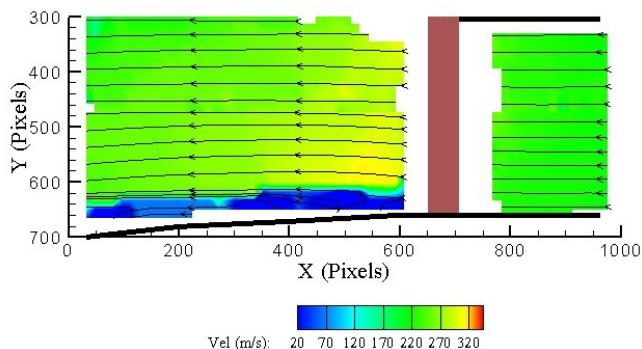
DR. GANGULY SELECTED FOR PRESTIGIOUS HONOR: The Propulsion Directorate's Dr. Biswa N. Ganguly was recently selected to receive the Meritorious Civilian Service Award in recognition of his distinguished performance from September 1993 to May 2004. Over this 10-year period, Dr. Ganguly provided international leadership and made significant contributions in a multitude of technical areas. Some of these areas include: plasma processing and diagnostics of wide bandgap semiconductors; high speed compact pulser development for non-equilibrium high pressure plasma generation; flow control through plasma-shock interactions; hypersonic propulsion; combustion and plume; and high flux radicals



Dr. Biswa N. Ganguly was recently selected to receive the Meritorious Civilian Service Award



PIV image captured during initial runs of PR's new wind tunnel



Streamlines and velocity contours derived from data taken during initial runs of the new wind tunnel

and atom sources development for aerospace applications. In these varied endeavors, Dr. Ganguly consistently demonstrated superior technical innovation resulting in significant accomplishments that will bear positive results for years to come for high temperature electronics, high speed flight, and space-based electronics. He further demonstrated superior vision by coupling his technical achievements at the basic research level to applications in Air Force systems. Dr. Ganguly's exceptional record of creativity and excellence has brought national and international recognition to himself and to the Air Force. (Mr. J. Weimer, AFRL/PRPE, (937) 255-6236)

SUPERCONDUCTIVITY TAPE FABRICATION SYSTEM COMING TO PR: A state-of-the-art Metal Organic Chemical Vapor Deposition (MOCVD) system being developed for multi-

kilometer length superconductivity tape production is to be delivered to the Propulsion Directorate's Superconductivity Group. The system is being developed by [Structured Materials Industries, Inc.](#) (SMI) of Piscataway, New Jersey, under a Missile Defense Agency (MDA) SBIR Phase II program titled, "[Multi-kilometer Superconducting Tape Production Tool.](#)" PR's Drs. Timothy Haugan and Paul Barnes recently visited SMI and expedited this delivery in order



A state-of-the-art Metal Organic Chemical Vapor Deposition (MOCVD) system is being developed for multi-kilometer length superconductivity tape production

to provide Cooperative Research and Development Agreement (CRADA) laboratory support to industry in developing MOCVD for continuous production. MOCVD is one of several methods chosen by industry for economic scaled-up fabrication of long length conductors. The system will greatly enhance the in-house research program on superconductivity by allowing real-time variable control of processing parameters to produce and analyze multiple samples on a continuous basis.

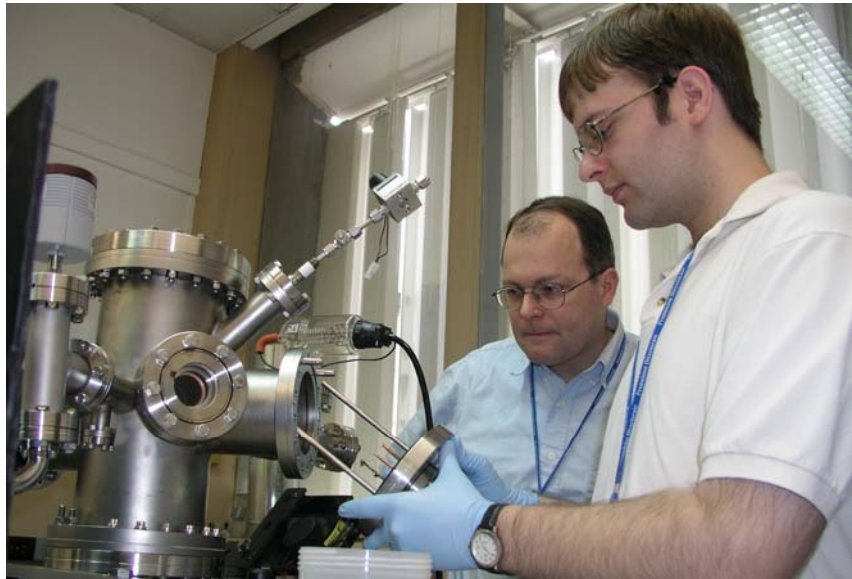
Superconducting transmission cables (i.e., tapes) offer more than a five-fold increase in power transmission through existing conduits to meet growing military and commercial consumer demands. For large scale power applications, such as motors and transformers, superconductors generally lead to a three- to five-fold reduction in weight and about a two-times reduction in size, even when including the cryocooling apparatus. These superconductor tapes are applicable to a wide array of high speed high power applications. (Dr. T. Haugan, AFRL/PRPG, (937) 255-7163)

DR. BARNES RECOGNIZED FOR EXCELLENCE IN BASIC RESEARCH: The Propulsion Directorate's Dr. Paul N. Barnes was recently selected for Honorable Mention for the 2004 Air Force Basic Research Award. This honor recognizes Dr. Barnes for his efforts to build a world-class research program in High Temperature Superconducting (HTS) coated conductors. HTS technology is an essential element needed for the design and development of future advanced, compact, high-power generator coils for aerospace applications, such as airborne directed energy weapons. Dr. Barnes is responsible for the planning, technical direction, and execution of in-house research for HTS coated conductors, and his group has achieved several world-class milestones. These breakthroughs have been documented both nationally and internationally in numerous journals and peer reviewed publications. Dr. Barnes' successes, including his leadership of a multidirectorate research team, have twice earned AFOSR STAR team designation for the HTS research group. The HTS team under Dr. Barnes' leadership has also

been honored with the Air Force Research and Development Award and the [Federal Laboratory Consortium Award for Technology Transfer](#). (Mr. S. Rubertus, AFRL/PRPG, (937) 255-6243)

INSULATION EXPERT
HONORED FOR

ACHIEVEMENTS: The Propulsion Directorate's Dr. Rusty L. Blanski recently received the Exemplary Civilian Service Award. Dr. Blanski was recognized for his distinguished service as a Senior Research Chemist at PR's Edwards Research Site, Edwards AFB, California, from June 2001 to May 2004. Dr. Blanski is a recognized national expert on the synthesis of new rocket motor insulation materials. He has led the way in the development, incorporation, and testing of nanotechnology for insulation materials on both near-term and long-term rocket programs, and he has demonstrated innovative thinking, research skill, and strong team-working in the development of these programs. He is also the insulation team lead for the Integrated High Payoff Rocket Propulsion Technology (IHPRPT) Materials Working Group, which oversees planning and funding on new material programs for rocket propulsion. Dr. Blanski's contributions have impacted the nation's entire rocket motor community and are already shaping the development of government in-house and US industry programs on rocket motor insulation. (Dr. S. Phillips, AFRL/PRSM, (661) 275-6270)



Dr. Paul N. Barnes (left) was recently selected for Honorable Mention for the 2004 Air Force Basic Research Award



Dr. Rusty L. Blanski recently received the Exemplary Civilian Service Award

COMPUTATIONAL CHEMISTRY EXPERT HONORED: The Propulsion Directorate's Dr. Jerry A. Boatz was recently selected to receive the Exemplary Civilian Service Award. Dr. Boatz was recognized for his distinguished service as a Senior Research Chemist at PR's Edwards Research Site, Edwards AFB, California, from January 2002 to May 2004. Dr. Boatz has taken on a leadership role in advocating and managing supercomputing resources for PR. As a leader within the DoD High Performance Computing (HPC) group, he has participated in



Dr. Jerry A. Boatz was recently selected to receive the Exemplary Civilian Service Award

several Challenge projects for applying HPC to the directorate's mission, as well as helping others to secure supercomputer time for their projects. He has also demonstrated expert ability in the use of computational chemistry to predict chemical and physical properties of proposed energetic materials and in devising and improving computational chemistry software. His expertise has saved AFRL chemists an estimated \$500,000 per year in trial and error synthetic chemistry and has been invaluable in identifying and synthesizing a number of compounds that hold the promise of breaking the traditional energy barriers of chemical propellants. Dr. Boatz' outstanding fundamental scientific work and ability to leverage HPC resources for PR's scientists and engineers have made a tremendous impact on recent quantum theory modeling and on energetic chemistry knowledge. (Dr. R. Channell, AFRL/PRSP, (661) 275-6442)

NEW SUPERCONDUCTING GENERATOR PROGRAM GETTING ATTENTION: A front page article[†] in the 26 September 2004 edition of the *Dayton Daily News* featured the Propulsion Directorate's new Superconducting Generator Program. The article, titled "Wright-Patt Nears Power Breakthrough," discusses PR's new Multi-megawatt Electric Power System Program. This program has a goal of demonstrating a 5 megawatt superconducting power system by 2009. At the heart of this system is a superconducting generator that is lighter and more efficient than conventional generators that use large copper coils. This is an enabling technology for directed energy weapons, and this work is closely tied to research being performed by the [Directed Energy Directorate \(AFRL/DE\)](#) at Kirtland AFB, New Mexico. The article features interviews with Lt Col JoAnn Erno, Chief of PR's Power Division (AFRL/PRP), and the division's lead

[†] Gaffney, Timothy R., "Wright-Patt nears power breakthrough," *Dayton Daily News*, September 26, 2004, pp. A1, A20.

researchers for this program, Drs. Charles Oberly and Paul Barnes. (Ms. C. Obringer, AFRL/PRP, (937) 255-6243)



Drs. Charles Oberly (left) and Paul Barnes (right) are the lead researchers for PR's new Multi-megawatt Electric Power System Program

INTEGRATION AND OPERATIONS DIVISION HOLDS INAUGURAL AWARDS: The Propulsion Directorate's Integration and Operations Division (AFRL/PRO) held its 1st Annual Awards Program on 21 September 2004. Since AFRL/PRO is geographically split between PR-East at Wright-Patterson AFB, Ohio, and PR-West at Edwards AFB, California, the awards were conducted via video-teleconference. The winners in the ten award categories were as follows:

Award	Recipient(s)
Junior Support Award	Ms. Veronica Norman (PROF)
Senior Support Award	Ms. Linda Hartsock (PROB)
Technical Support Award	Mr. Jack Vondrell (PROP)
Technology Infusion Award	Messrs. Hank Grinner and Jack Huey (PROE)
Engineer of the Year	Mr. Brad Urwiller (PROI)
Program Management Award	Mr. Dave Dye and Ms. Lesley Murawski (PROE)
Staff Support Award	Ms. Laurie Regazzi (PROB) and Ms. Debbie Spotts (PROI)

Award	Recipient(s)
Integration and Operations Team Award	PR Environmental, Safety and Occupational Health (ESOH) Team: Messrs. Thanh Chu, Jim McMahon, and Mike Schumacher (PROE); and Messrs. Reggie Ching, Ken Gurley, Tom Hendron, and Dan Schwartz (PROF)
Leadership Award	Mr. Curt Kessler (PROE)
Supervisor of the Year	Ms. Deb Fuller (PROF)

Congratulations to all of the winners! (Ms. A. Kuphal, AFRL/PRO, (661) 275-5343)

DR. PHILLIPS ADDRESSES NANOWORLD 2004 CONFERENCE: Dr. Shawn H. Phillips, Chief of the Propulsion Directorate's Propulsion Materials Applications Branch (AFRL/PRSM),



Dr. Shawn Phillips was a keynote speaker at the IEEE NANOWorld 2004 Conference

was a keynote speaker for the Institute of Electrical and Electronics Engineers (IEEE) [NANOWorld 2004 Conference](#) in Anaheim, California. On 21 September 2004, Dr. Phillips gave an address titled, [“From Nanoscience to Nanotechnology: The Development and Application of Polyhedral Oligomeric Silsesquioxanes \(POSS\) as Versatile Engineering Nanomaterials.”](#) This well-received talk covered POSS nanostructured materials for polymers, including their history, properties, and applications, with a strong emphasis on the building-block/nanoengineering approach for maximum property enhancements. NANOWorld is the first conference and exposition devoted to commercial applications, practical solutions, and cutting edge products of the core technology that is driving the nanotechnology industry. (Dr. S. Phillips, AFRL/PRSM, (661) 275-6270)